Trends in the mathematics proficiency of 9-, 13-, and 17-year-olds

Proficiency in mathematics is an important outcome of education. The mathematics skills of the Nation's workers may be a crucial component of its economic competitiveness. In an increasingly technological world, knowledge of mathematics is critical for success in scientific and engineering occupations. It is also essential for those working in the growing number of diverse occupations that use computers as a foundation for their activities, such as graphic designers, librarians, and business managers.

- Average mathematics proficiency improved between 1978 and 1996 for all age groups, with 9-year-olds making the largest improvements. Another mathematics assessment, one that reflects recent curricular emphasis and mathematics standards developed by the National Council for Teachers of Mathematics, showed that scores for 4th-, 8th-, and 12th-graders increased between 1990 and 1996 (see supplemental table 18-2).

- Several states had significant increases in average mathematics scores between 1992 and 1996. Of the 38 jurisdictions in which 4th-graders participated, 15 states showed significant improvements in mathematics scores between 1992 and 1996. Of the 36 jurisdictions in which 8th-graders participated, 13 states showed significant improvements between 1992 and 1996 (see supplemental table 18-3). No state showed a significant decline at the 8th-grade level.

- Between 1978 and 1996, average scores for white students were higher than those for black and Hispanic students at all age levels. However, the scores of white 13- and 17-year-olds increased at a slower rate than the scores of their black and Hispanic peers, causing the gap in mathematics proficiency to decrease for these racial/ethnic groups over the last 20 years.

Average mathematics proficiency (scale score), by sex and age: 1973–96

	Total			Male			Female		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	[1]219	[1]266	304	[1]218	[1]265	309	[1]220	[1]267	301
1978	[1]219	[1]264	[1]300	[1]217	[1]264	[1,2]304	[1]220	[1]265	[1]297
1982	[1]219	[1]269	[1,2]298	[1]217	[1]269	[1,2]302	[1]221	[1]268	[1,2]296
1986	[1]222	[1]269	[1]302	[1,2]222	[1,2]270	305	[1]222	[1]268	[1]299
1990	[2]230	[1,2]270	305	[2]229	[1,2]271	306	[2]230	270	303
1992	[2]230	[2]273	307	[2]231	[2]274	309	[2]228	[2]272	[2]305
1994	[2]231	[2]274	306	[2]232	[2]276	309	[2]230	[2]273	304
1996	[2]231	[2]274	307	[2]233	[2]276	310	[2]229	[2]272	[2]305

Average mathematics proficiency (scale score), by race/ethnicity and age: 1973–96

	White			Black			Hispanic		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	[1]225	[1]274	310	[1]190	[1]228	[1]270	[1]202	[1]239	[1]277
1978	[1]224	[1]272	[1,2]306	[1]192	[1]230	[1]268	[1]203	[1]238	[1]276
1982	[1]224	[1]274	[1,2]304	[1]195	[1,2]240	[1]272	[1]204	[2]252	[1]277
1986	[1]227	[1]274	[1]308	[1,2]202	[2]249	[2]279	[1]205	[2]254	283
1990	[2]235	[1]276	310	[2]208	[2]249	[2]289	[2]214	[2]255	284
1992	[2]235	[2]279	312	[2]208	[2]250	[2]286	[2]212	[2]259	[2]292
1994	[2]237	[2]281	312	[2]212	[2]252	[2]286	[2]210	[2]256	[2]291
1996	[2]237	[2]281	313	[2]212	[2]252	[2]286	[2]215	[2]256	[2]292

[1] Statistically significant difference from 1996.

[2] Statistically significant difference from 1973.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments. The mathematics proficiency scale has a range of 0 to 500. (See supplemental table 18-1 for further explanations of levels.)

Level 150: Simple arithmetic facts

Level 200: Beginning skills and understanding

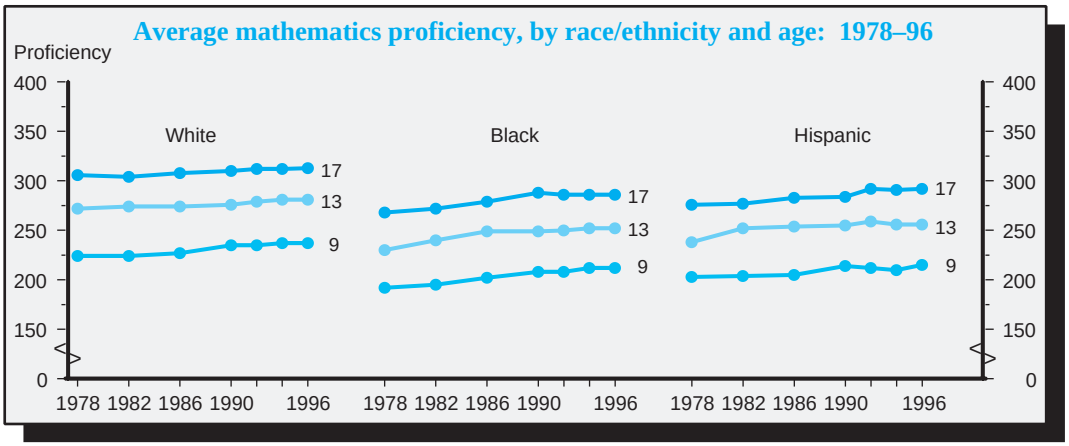
Level 250: Numerical operations and beginning problem solving

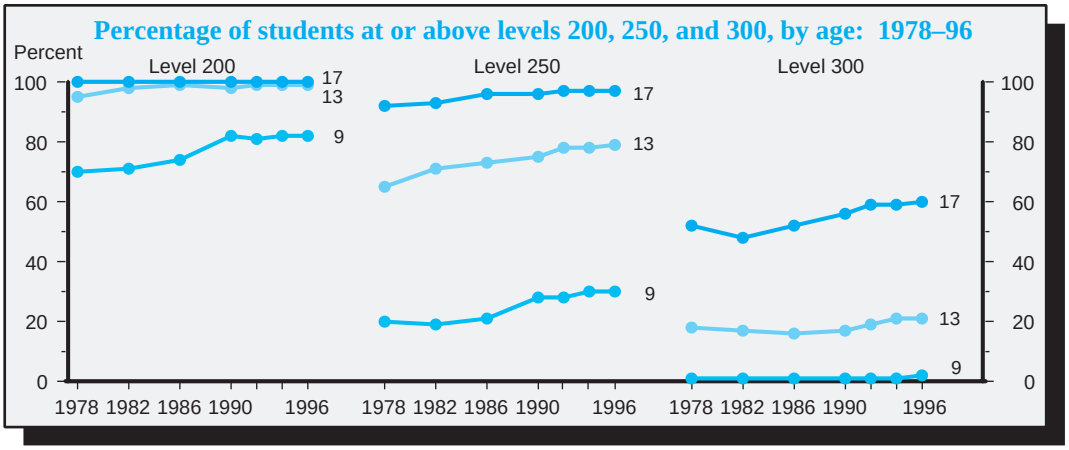
Level 300: Moderately complex procedures and reasoning

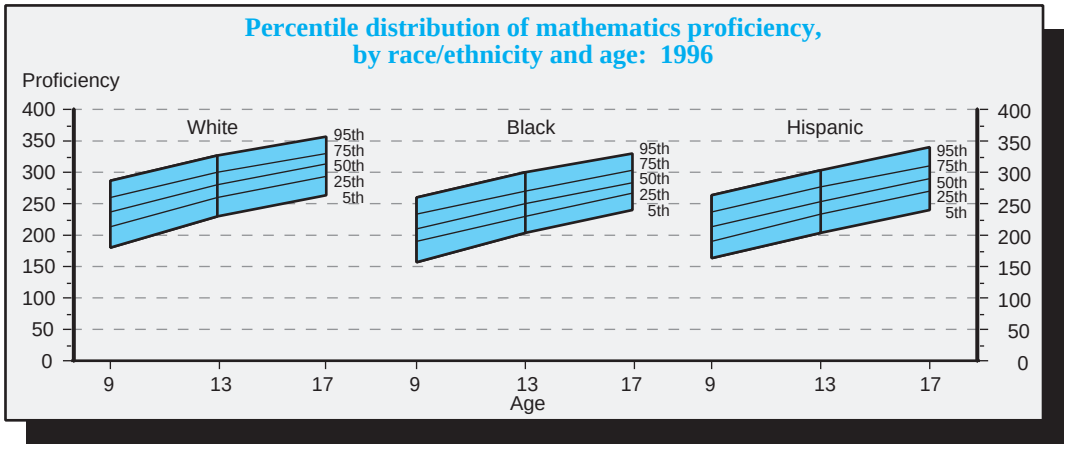
Level 350: Multi-step problem solving and algebra

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Average mathematics proficiency (scale score)







NOTE: The mathematics proficiency scale has a range from 0 to 500. (See supplemental table 18-1 for further explanations of levels.)

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Table 18-1 Explanations of levels of mathematics proficiency

Level 150:	**Simple arithmetic facts** Students at this level know some basic addition and subtraction facts, and most can add two-digit numbers without regrouping. They recognize simple situations in which addition and subtraction apply. They also are developing rudimentary classification skills.
Level 200:	**Beginning skills and understanding** Students at this level have considerable understanding of two-digit numbers. The can add two-digit numbers, but are still developing an ability to regroup in subtraction. They know some basic multiplication and division facts, recognize relations among coins, can read information from charts and graphs, and can use simple measurement instruments. They are developing some reasoning skills.
Level 250:	**Numerical operations and beginning problem solving** Students at this level have an initial understanding of the four basic operations. They are able to apply whole number addition and subtraction skills to one-step word problems and money situations. In multiplication, they can find the product of a two-digit and a one-digit number. They can also compare information from graphs and charts, and are developing an ability to analyze simple logical relations.
Level 300:	**Moderately complex procedures and reasoning** Students at this level are developing an understanding of number systems. They can compute with decimals, simple fractions, and commonly encountered percents. They can identify geometric figures, measure lengths and angles, and calculate areas of rectangles. These students are also able to interpret simple inequalities, evaluate formulas, and solve simple linear equations. They can find averages, make decisions on information drawn from graphs, and use logical reasoning to solve problems. They are developing the skills to operate with signed numbers, exponents, and square roots.
Level 350:	**Multi-step problem solving and algebra** Students at this level can apply a range of reasoning skills to solve multi-step problems. They can solve routine problems involving fractions and percents, recognize properties of basic geometric figures, and work with exponents and square roots. They can solve a variety of two-step problems using variables, identify equivalent algebraic expressions, and solve linear equations and inequalities. They are developing an understanding of functions and coordinate systems.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Table 18-2 Average mathematics scale scores, by grade: 1990–96

Grade	1990	1992	1996
4	213	[1]220	[1,2]224
8	263	[1]268	[1,2]272
12	294	[1]299	[1,2]304

[1] Statistically significant difference from 1990.

[2] Statistically significant difference from 1992.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments.

SOURCE: U.S. Department of Education, National Center for Education Statistics, *NAEP 1996 Mathematics Report Card for the Nation and the States: Findings from the National Assessment of Educational Progress,* 1997.

Table 18-3 Average mathematics scale scores of public school fourth- and eighth-graders, and change in scores from 1992 and from 1990, by grade and state: 1996

	Grade 4		Grade 8		
State or jurisdiction	Average scale score	Change from 1992 average scale score	Average scale score	Change from 1992 average scale score	Change from 1990 average scale score
National average	**222**	**[2]4**	**271**	**5**	**8**
Alabama	212	3	257	4	4
Alaska[1]	224	—	278	—	—
Arizona[1]	218	2	268	3	[3]8
Arkansas	216	[2]6	262	[2]5	[3]5
California	209	1	263	2	[3]6
Colorado	226	[2]5	276	3	[3]8
Connecticut	232	[2]5	280	[2]6	[3]10
Delaware	215	[2]-3	267	[2]4	[3]6
District of Columbia	187	[2]-5	233	-2	1
Florida	216	2	264	4	[3]8
Georgia	215	0	262	3	4
Hawaii	215	1	262	[2]5	[3]11
Indiana	229	[2]8	276	[2]5	[3]8
Iowa[1]	229	-1	284	1	[3]6
Kentucky	220	[2]5	267	[2]4	[3]9
Louisiana	209	[2]5	252	2	[3]6
Maine	232	1	284	[2]5	—
Maryland	221	3	270	5	[3]9
Massachusetts	229	2	278	5	—
Michigan[1]	226	[2]6	277	[2]10	[3]12
Minnesota	232	[2]4	284	2	[3]9
Mississippi	208	[2]7	250	4	—
Missouri	225	3	273	2	—
Montana[1]	228	—	283	—	3
Nebraska	228	2	283	[2]5	[3]7
Nevada[1]	218	—	—	—	—
New Jersey[1]	227	0	—	—	—
New Mexico	214	1	262	2	[3]6
New York[1]	223	[2]4	270	4	[3]9
North Carolina	224	[2]11	268	[2]9	[3]17
North Dakota	231	2	284	1	3
Oregon	223	—	276	—	[3]5
Pennsylvania[1]	226	2	—	—	—
Rhode Island	220	[2]5	269	[2]3	[3]9

Table 18-3 Average mathematics scale scores of public school fourth- and eighth-graders, and change in scores from 1992 and from 1990, by grade and state: 1996—Continued

	Grade 4		Grade 8		
State or jurisdiction	Average scale score	Change from 1992 average scale score	Average scale score	Change from 1992 average scale score	Change from 1990 average scale score
South Carolina[1]	213	1	261	0	—
Tennessee	219	[2]8	263	4	—
Texas	229	[2]11	270	[2]6	[3]12
Utah	227	2	277	2	—
Vermont[1]	225	—	279	—	—
Virginia	223	2	270	2	[3]5
Washington	225	—	276	—	—
West Virginia	223	[2]8	265	[2]6	[3]9
Wisconsin	231	3	283	5	[3]8
Wyoming	223	-2	275	0	[3]3

— Not available. State did not participate in the assessment for one or more years.

[1] State did not satisfy one or more of the guidelines for school participation rates in 1996.

[2] Change between 1992 and 1996 is statistically significant.

[3] Change between 1990 and 1996 is statistically significant.

SOURCE: U.S. Department of Education, National Center for Education Statistics, *NAEP 1996 Mathematics Report Card for the Nation and the States: Findings from the National Assessment of Educational Progress,* 1997.

Table 18-4 Percentage of students scoring at or above five levels of mathematics proficiency: 1978–96

		Year						
Proficiency levels	Age	1978	1982	1986	1990	1992	1994	1996
Level 150:	9	[1]97	[1]97	[1,2]98	[2]99	[2]99	[2]99	[2]99
Simple arithmetic	13	100	100	100	100	100	100	100
facts	17	100	100	100	100	100	100	100
Level 200:	9	[1]70	[1]71	[1]74	[2]82	[2]81	[2]82	[2]82
Beginning skills and	13	[1]95	[2]98	[2]99	[2]99	[2]99	[2]99	[2]99
understandings	17	100	100	100	100	100	100	100
Level 250:	9	[1]20	[1]19	[1]21	[2]28	[2]28	[2]30	[2]30
Numerical operations and	13	[1]65	[1,2]71	[2]73	[2]75	[2]78	[2]78	[2]79
beginning problem solving	17	[1]92	[1]93	[2]96	[2]96	[2]97	[2]97	[2]97
Level 300:	9	[2]1	[2]1	1	1	1	1	[2]2
Moderately complex	13	18	17	[1]16	17	19	21	21
procedures and reasoning	17	[1]52	[1]49	[1]52	56	[2]59	[2]59	[2]60
Level 350:	9	0	0	0	0	0	0	0
Multi-step problem	13	1	1	[2]0	[2]0	0	1	1
solving and algebra	17	7	[2]6	7	7	7	7	7

[1] Statistically significant difference from 1996.

[2] Statistically significant difference from 1978.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Table S18(a) Standard errors for the first text table in *Indicator 18*

	Total			Male			Female		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	0.8	1.1	1.1	0.7	1.3	1.2	1.1	1.1	1.1
1978	0.8	1.1	1.0	0.7	1.3	1.0	1.0	1.1	1.0
1982	1.1	1.1	0.9	1.2	1.4	1.0	1.2	1.1	1.0
1986	1.0	1.2	0.9	1.1	1.1	1.2	1.2	1.5	1.0
1990	0.8	0.9	0.9	0.9	1.2	1.1	1.1	0.9	1.1
1992	0.8	0.9	0.9	1.0	1.1	1.1	1.0	1.0	1.1
1994	0.8	1.0	1.0	1.0	1.3	1.4	0.9	1.0	1.1
1996	0.8	0.8	1.2	1.2	0.9	1.3	0.7	1.0	1.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress,* 1997.

Table S18(b) Standard errors for the second text table in *Indicator 18*

	White			Black			Hispanic		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	1.0	0.9	1.1	1.8	1.9	1.3	2.4	2.2	2.2
1978	0.9	0.8	0.9	1.1	1.9	1.3	2.2	2.0	2.3
1982	1.1	1.0	0.9	1.6	1.6	1.2	1.3	1.7	1.8
1986	1.1	1.3	1.0	1.6	2.3	2.1	2.1	2.9	2.9
1990	0.8	1.1	1.0	2.2	2.3	2.8	2.1	1.8	2.9
1992	0.8	0.9	0.8	2.0	1.9	2.2	2.3	1.8	2.6
1994	1.0	0.9	1.1	1.6	3.5	1.8	2.3	1.9	3.7
1996	1.0	0.9	1.4	1.4	1.3	1.7	1.7	1.6	2.1

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress,* 1997.